



Defense Energy Support Center
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**Product
Technology
&
Standardization
Division**

Alternative Fuels Information Station

Biodiesel Fuel Tutorial





Learning Objectives

For Over
60 Years

LOGISTICS

DEFENSE

AGENCY

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You should learn....

- The definition of biodiesel fuel and biodiesel fuel blends
- The role of biodiesel fuel as an EPAct 1992 alternative fuel
- How biodiesel fuel is made
- The advantages and disadvantages of using biodiesel fuel
- Physical and chemical properties of biodiesel fuel/B20 biodiesel blend
- The handling and storage requirements for biodiesel





Using Biodiesel Fuel to Comply with EPAct



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Energy Policy Act 1992

**E.O. 13149:
Greening the Government
through
Federal Fleet & Transportation Efficiency**

Requirement

The Energy Policy Act 1992 mandates that 75% covered vehicle acquisitions be AFVs.

Fleet Manager Goal

The fleet manager can procure according to the EPAct requirement

OR



The fleet manager can procure a combination of AFVs and Biodiesel fuel credits



Using Biodiesel to Receive EPAct Credits

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Energy Policy Act 1992

**E.O. 13149:
Greening the Government
through
Federal Fleet & Transportation Efficiency**

Credits Awarded	Situation Earning Credits
1	A light-duty, alternative fuel vehicle
2	A dedicated light-duty vehicle
3	A dedicated medium-duty, alternative fuel vehicle
4	A dedicated heavy-duty, alternative fuel vehicle
1	For every 450 gallons of pure biodiesel (equivalent to 2,250 gallons of B-20) used in diesel vehicles with earned credits of up to 50% of EPAct requirements only.





EPAct Biodiesel Credits

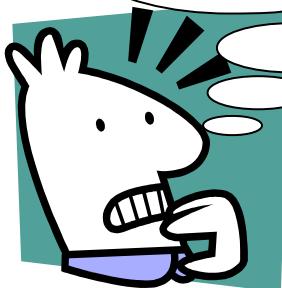


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Example: Use of Bio-Diesel to acquire EPAct credits to meet the 75% yearly AFV procurement requirement of EPAct

Remember.....

- * Light Duty AFV = 1 credit
- * 75% of all covered vehicles must be AFVs



Assume: Present Service Fleet of 40 Vehicles

- 20 Light-Duty Gasoline Vehicles
- 10 Medium Duty Diesel Vehicles
- 10 Light-Duty AFVs

Acquire 10 new cars in FY04:

- Four Light Duty Gasoline Vehicles
- Six Light Duty AFVs

	Acquisition s (FY 04)	# of New AFV Credits	Biodiesel Credits	Percentage AFV
Scenario 1	10	6	0	60%
Scenario 2	10	6	2	80%

- * The Percentage AFV is calculated in each scenario by dividing total credits earned by the total number of vehicle acquisitions for the year.
- * Scenario 2 requires procurement of 2 x 2250 gallons of B20!





BIODIESEL AND BIODIESEL BLENDS



PRODUCT DEFINITIONS

BIODIESELS- **Mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats**

BIODIESEL BLENDS (Bxx)- **Blends of biodiesel fuel with petroleum based diesel fuel.**

Reminder: Diesel Fuel is a middle distillate fuel designed (per ASTM D 975) for diesel engines





BIODIESEL AND BIODIESEL BLENDS



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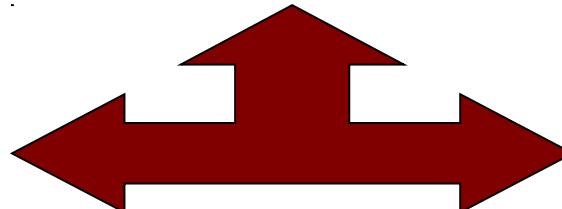
Biodiesel Raw Materials

Oil or Fat

Soybean
Corn
Canola
Cottonseed
Sunflower
Beef tallow
Pork Lard
Used Cooking Oils
Others

Alcohol

Methanol
Ethanol



Catalyst
Sodium Hydroxide
Potassium Hydroxide

Reminder: Diesel Fuel is a middle distillate fuel designed (per ASTM D 975) for diesel engines

Source: www.afdc.doe.gov





Biodiesel Reaction Sequence

BIODIESEL AND BIODIESEL BLENDS

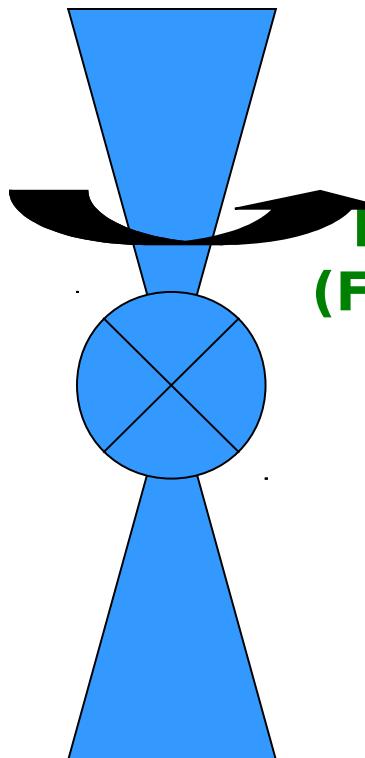


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Combining

**Vegetable Oil
Or
Animal Fat
(100 lbs.)**
+
**Methanol or
Ethanol
(10 lbs.)**

In the Presence of a Catalyst



Yields

**Biodiesel+ Fatty Acids
(Fatty Acid Methyl-Ester)
FAME
(100 lbs.)**
+
**Glycerin
(10 lbs.)**



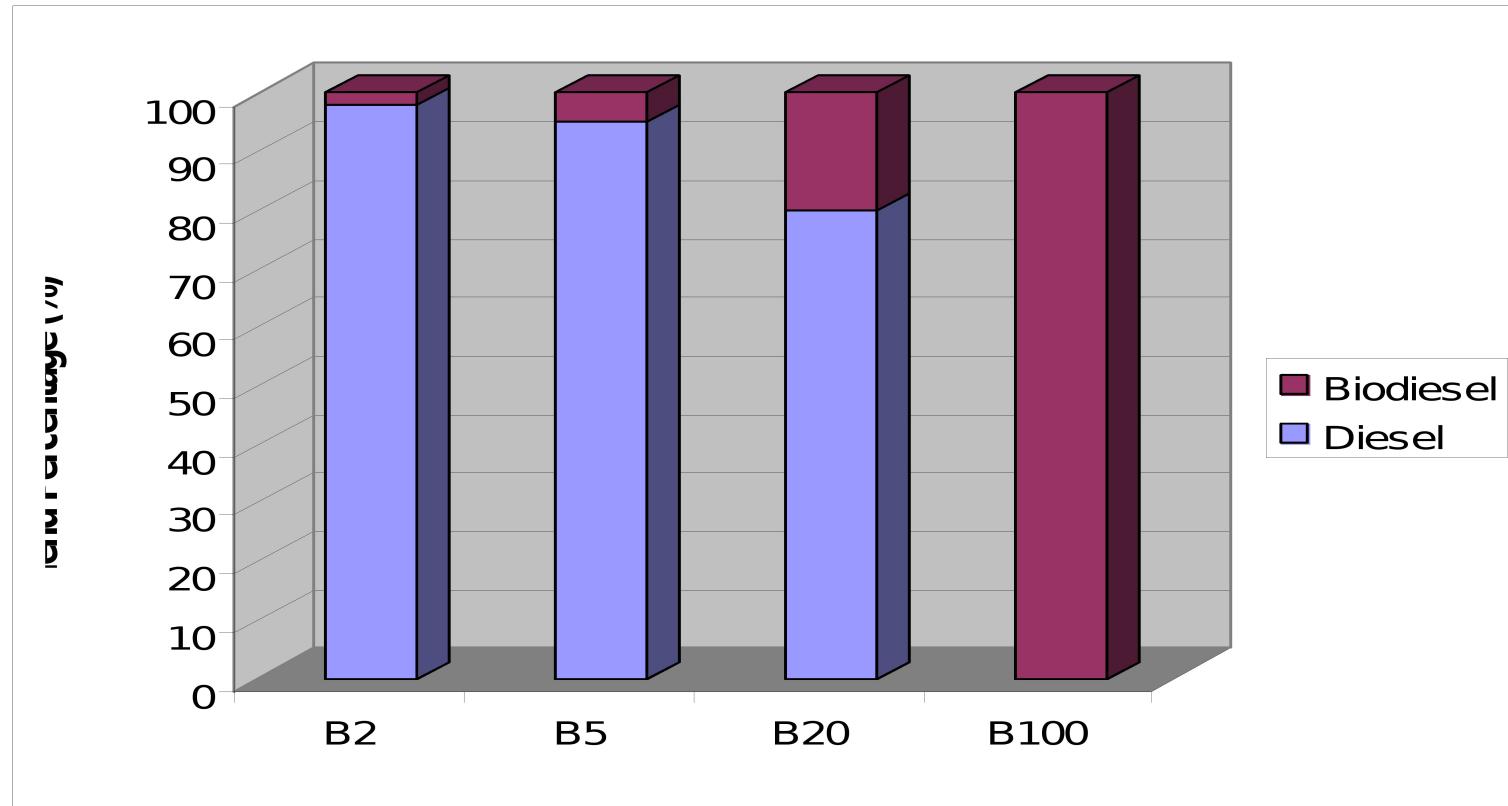


Biodiesel Blends



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BIODIESEL AND BIODIESEL BLENDS



Example: B5 is 5% biodiesel & 95% diesel





BIODIESEL AND BIODIESEL BLENDS



Accepted technical specification....

- Biodiesel (B100) ASTM Specification D-6751
For Biodiesel Fuel Blend Stock for Distillate Fuels
Commonly used as a blend stock with petroleum based diesel fuels and is registered with EPA under 40CFR79
- Biodiesel Blend (B20)
B100 fuel blended with 80 percent petroleum diesel fuel oils, grade low sulfur number 1-D or grade sulfur 2-D (ASTM D





Biodiesel Properties

For Over
60 Years

LOGISTICS

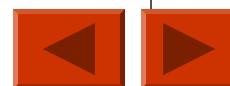
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Biodiesel/Biodiesel Blends

Property	Units	Test Method (ASTM)	Value	
			B100	B20
Flash Point	Deg C	D 93	130 min	38 min
Water and Sediment	% Volume	D 2709	.050 max	.05 max
Kinematic Viscosity, 40 C	mm ² /s	D 446	1.9-6.0	1.3-4.1
Sulfated Ash	% mass	D 874	.020 max	
Sulfur	% mass	D 5453	.05 max	.05 max
Copper Strip Corrosion		D 130	No. 3 max	No. 3 max
Cetane Number		D 613	47 min	40 min
Cloud Point	Deg C	D 2500	Report*	Per Table 1, D975
Carbon Residue	% mass	D 4530	.050 max	Set after add. data
Acid Number	mg KOH/g	D 664	.80 max	0.2 max
Free Glycerin	% mass	D 6584	0.02	N/A
Total Glycerin	% mass	D 6584	0.24	N/A
Phosphorus Content	% mass	D 4951	.001 max	N/A
Distillation Temperature	Deg C	D 1160	360 max	338 max
Atmosphere Equiv. Temp				
90% Recovered				





Key Advantages of Biodiesel Fuel (B100)



- ✓ **Made from waste products**
- ✓ **Use with standard, existing equipment**
- ✓ **Reduces CO₂ emissions by more than 75%**
- ✓ **Can be used in conventional diesel engines**
- ✓ **Fewer particulate emissions of CO and sulfur dioxide**
- ✓ **Potentially safer to transport and store:
flashpoint of (150 C-typical vs. 77 C-typical for petroleum diesel)**





Present Limitations of Biodiesel Fuel

For Over
60 Years

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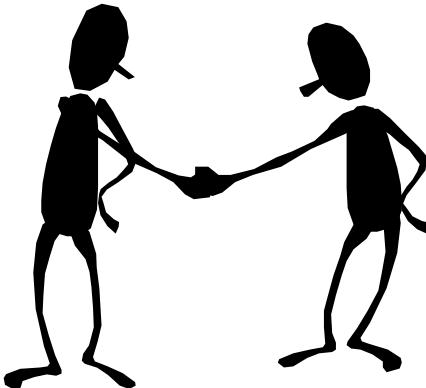
- X **Warranties with engine manufacturers**
- X **Increase in NOx emissions relative to petroleum diesel**
- X **Limited capacity at present (limited quantities available)**
- X **Cold weather concerns**
- X **Limited approved distribution access
(none in New England / one in S. East)**





Supplying DoD with Biodiesel

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✓ **Every supplier of pure biodiesel fuel must be registered!**

OR



- ✓ **Third party non-registrants can show registration of the supplier .**
- ✓ **A cover letter acknowledging that he is the very current supplier**

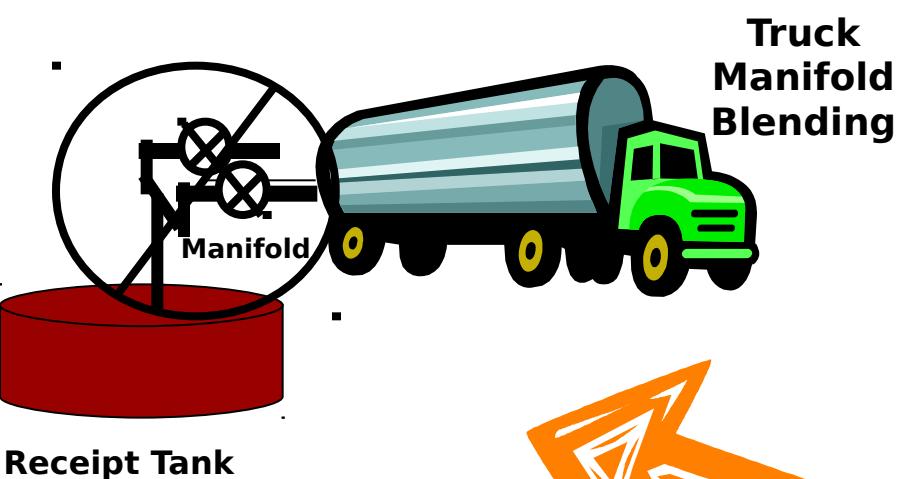




Blending Procedures for B20

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Techniques NOT permitted by DoD Specification



Splash Tank
Blending
In
Receipt
Tanks

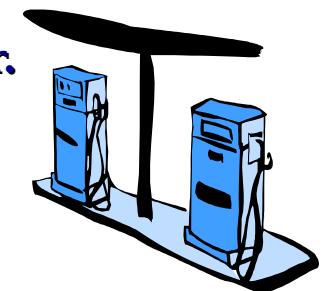




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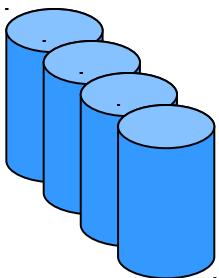
A Common Accepted Blending Method

- 1. Diesel fuel is picked up at supplier loading rack and driven to B100 supplier.**
- 2. The warm/hot B100 is added to the diesel fuel**
- 3. Blending occurs during transportation to the customer.**

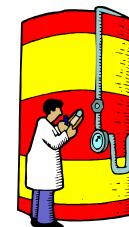


1

**Diesel
Fuel Supplier**



**Note: Hit space bar to drive
truck to destination 2 and 3**



2
**Biodiesel
(B100)
Supplier**





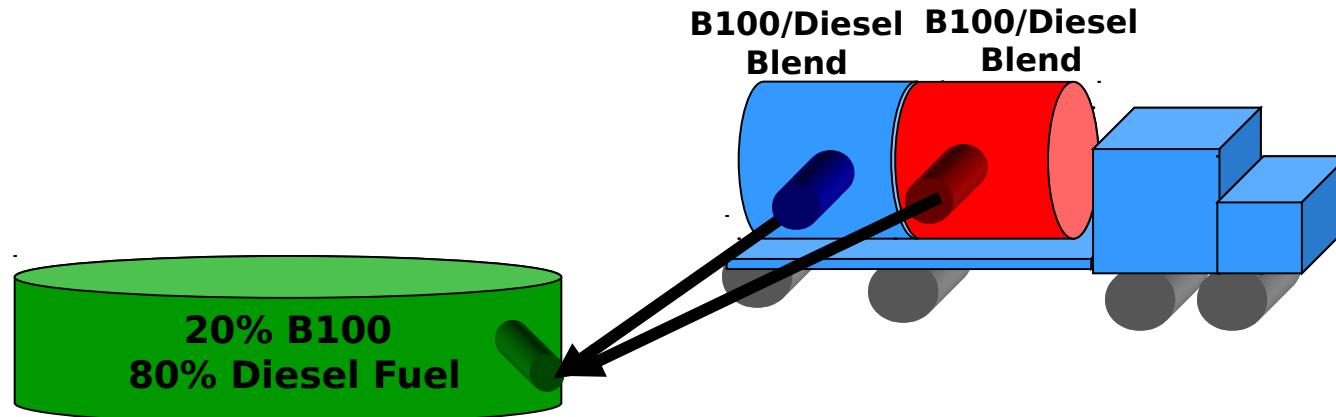
Compartment Blending of Biodiesel



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Blending in a compartmentalized truck IS acceptable WHEN:

Each compartment of the truck contains a biodiesel blend (BXX). The net discharge into receipt tank must be B20!!!



Note: The product in each compartment may not be equivalent to B20, but when all compartments are discharged to receipt tank, the must be 20% biodiesel.



Cold Weather Concerns



- It is critical that product meet the tenth percentile of the ASTM D975 diesel fuel specification for cloud point (CFPP can be substituted for cloud point with the appropriate adjustment to the required low temperature)**

But there is hope.....



- Cold temperature additives are being developed to work specifically with Biodiesel and are approved for use in admin vehicles**





Storage Stability



- **Although the product is improving constantly, storage stability still remains a concern**
- **Data shows that yellow grease blendstock may actually be a bit more stable in storage (the DESC 16.27 clause now permits B100 from a yellow grease feedstock)**
- **Storage stability additives are being perfected**
- **B20 should never be ordered any more than monthly during periods of temperature change**
- **DESC will not supply product if it does not meet the specification requirements**





Educational Tools



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- **<https://www.denix.osd.mil/> (Defense Environmental and Information Exchange)(DoD strategy, Military Services AFV Reporting requirements)**
- **National Biodiesel Board.**
[**http://www.biodiesel.org/resources/biodiesel_basics/**](http://www.biodiesel.org/resources/biodiesel_basics/)
(What is it, How is it made)





Summary

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